XV. Mollusca:

A) Cephalopoda.

By

Wm. Evans Hoyle.

With Plate Va and 10 Text-Figures.

33*

The collection includes the following species:

1. *Polypus schultzei* n. sp.
2. *Moschites nigra* n. sp.
3. *Loligo reynaudi.*
4. *Sepia tuberculata.*

The first two species are additions to our knowledge; the third and fourth are of interest because, although one of them was described seventy years and the other more than a century ago, they do not seem to have been met with by any traveller for very many years. I have taken advantage of their occurrence in this collection to give a full description, with a few necessary figures.

All the specimens were taken in the Lüderitzbucht, Angra Pequena, German South West Africa, among the rocks in shallow water.

I am indebted to the Rev. H. M. Gwatkin for mounting examples of the Radulae, to Miss Mary Brockington for some of the drawings and to Mr. J. T. Wadsworth for preparing sections, and I desire here to tender my thanks to these collaborators.

Polypus schultzei n. sp.

Locality: Angra Pequena. One specimen, ♂ (H 1365)[1]).

The Body is comparatively small and ovoid, but so distorted that it is impossible to give any more detailed description. The siphon has been forcibly reflexed, but is small, and in its natural position, would not have reached more than one third of the distance towards the margin of the umbrella.

The Head has been compressed out of all recognition by a ligature of some kind having been tied tightly round the junction of the head with the roots of the arms.

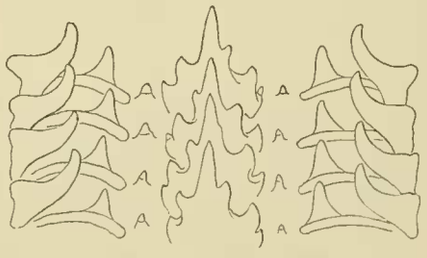

Fig. 1. Radula of *Polypus schultzei*. ×20.

The Arms (Pl. Va, Fig. 1) are stout and well developed, but so many of them seem to have been injured in one way or another that it is difficult to give any account, of what their relative lengths would be under normal conditions.

The Umbrella is well developed; between the dorsal arms, it reaches up to the 14th sucker. It becomes gradually less developed between the other arms proceeding towards the ventral surface and is narrowest between the ventral pair. The suckers vary greatly in diameter, much enlarged ones being found on all the upper arms. On the right ventral arm they increase gradually for about the first quarter of the arm and then diminish. On the third right arm the increase in size is much more rapid, the eighth sucker attaining a diameter of abut 1 cm. On the second right arm the largest sucker attains a diameter of 11 mm, whilst on the dorsal arms the largest suckers are 12 mm in diameter in the contracted condition,

1) These numbers refer to my own register.

and would be much larger when the animal was alive. On the second left arm the enlargement of the suckers is much less marked; but this arm is much smaller than the others and has very likely been mutilated at some time or other. The third left arm corresponds almost exactly with its fellow of the opposite side. On the left ventral arm the eighth sucker is the largest and attains a diameter of 1 cm. The third right arm is hectocotylised (Fig. 2). The groove along the outer ventral edge is extremely well developed having a breadth of about 3 mm in the middle of the arm. The extremity (Fig. 3) is bluntly rounded and does not present the usual longitudinal groove on the inner aspect. Instead of this there is a deep pit with folded margins about three-quarters of the distance from the base to the apex, and there are a number of small cracks around this as well as here and there along the sides of the tip. These have every appearance of being normal structures, but it is just possible they may be due to injury or defective preservation.

The Surface except for the wrinkling due to the spirit appears to be smooth all over. There are no definite papillae or excrescences of any kind.

The Colour is a dull purple somewhat paler below.

Dimensions of Specimen H 1365.

	mm		mm
Length, total	245	Eye to edge of umbrella	74
End of body to mantle margin	37	Length of hectocotylus	4
End of body to eye	50	Breadth of hectocotylus	2,5
Breadth of body	48	Diameter of largest sucker on arm	11

	Right	Left		Right	Left
Length of first arm	140 [1])	180 [1])	Length of third arm	161	193
Length of second arm	204	141	Length of fourth arm	149	146

This species is distinguished from all others known to me by the structure of the extremity of the hectocotylised arm, and by the fact that enlarged suckers are borne on all the arms except the ventral pair. It is most likely that this character will be found to be confined to the males, but I am not acquainted with any named form from South Africa which could be the female of this species.

Moschites nigra n. sp.

Locality: Angra Pequena. Seven specimens, 1 ♂, 6 ♀ (H 1358—1363).

The Body is flattened ovate, broader behind than in front, with a faint indication of a median groove on the lower surface. The mantle opening extends half-way round the body, terminating a little behind and below each eye. The siphon is of rather more than average length, slender and conical, reaching fully half-way to the margin of the umbrella between the ventral arms.

The Head is comparatively narrow and the eyes not very prominent.

The Arms are sub-equal; the ventral pair shortest; the three superior pairs nearly equal, the order of length thus being 1 = 2 = 3, 4; they vary from four and a half to five times the length of the body, and taper gradually to very slender points. The umbrella is well developed all round, but is narrower between the ventral than between the dorsal arms. The suckers are in a single series for the greater part of all the arms, but for a few centimetres in the proximal third of the arm, where they are the largest, they are displaced alternately to either side of the middle line, though without forming two definite rows. The margin of each sucker bears a ring of close-set knobs; the disc is covered with a thick cuticle, which is very easily detached, and when it is removed shows very clear radial grooves, reaching to the central

1) Mutilated.

hollow where they are separated by small projection. One of the smaller specimens shows a minute hectocotylised extremity to the third right arm, but it is too little developed to show any characteristic features, and the groove leading up to it is but slightly indicated.

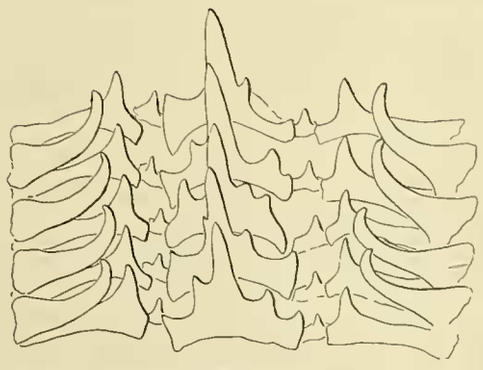

Fig. 2. Radula of *Moschites nigra*. × 200.

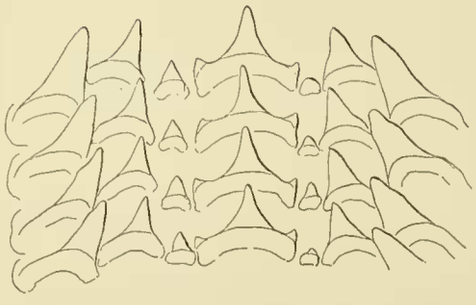

Fig. 3. Radula of an Octopod. × 40.

The Surface is practically smooth, except for wrinkles apparently due to the action of the spirit; here and there on the body are traces of a shagreen-like pattern.

The Colour is a very deep brown, almost black. The smaller specimens are even darker in colour than the large one.

Dimensions of Specimen H 1362.

	mm		mm
End of body to mantle margin	32	Breadth of head	22
End of body to eye	40	Eye to edge of umbrella	38
Breadth of body	32	Diameter of largest sucker	6

	Right	Left		Right	Left
Length of first arm	147	146	Length of third arm	140	148
Length of second arm	140	150	Length of fourth arm	140	140

This species is well characterised by the very dark colouration, which suggested its specific name.

Undetermined Octopod.

One of the tubes in which the collection was received contained a buccal mass labelled "Radula eines Octopoden" (H 1364). It is very unfortunate that the whole specimen was not preserved for it does not belong to the same species or even genus as any other specimen in the collection.

I have figured the radula (Textfig. 3) and am inclined to think it belongs to a species of *Tremoctopus*.

Loligo reynaudi.

1845 *Loligo reynaudii* d'Orbigny, Moll. viv. et foss., p. 346, tab. 19, fig. 5.
1848 „ „ d'Orbigny, in: Férussac et d'Orbigny, Monogr. Céphalopodes acétabulifères, 1834—48, p. 315, tab. 24.

Locality: Angra Pequena. Three specimens, ♂ (H 1352—1354).

The Body is slender and elongated, about four times as long as broad. It tapers gradually from the anterior towards the posterior extremity, where it ends in a bluntly rounded point. The fin occupies three-quarters of the length of the mantle; its breadth is four-fifths of its length, and it is rhomboidal with

rounded lateral angles. The mantle margin has a very well marked prominence in the dorsal median line, and slighter projections on either side ventrally. The siphon is well developed reaching forward as far as the anterior margin of the eye.

The Head is of moderate size; the auricular crest is well developed, and presents a double sigmoid curve.

The Arms are unequal, the order of length being 3, 4, 2, 1; the longest is nearly half the length of the mantle. They taper gradually to very fine points, and have the arrangment of keels and protective membranes usual in the genus. The left ventral arm is hectocotylised. In the last 2 cm the suckers gradually disappear giving place to conical papillae of the usual type. The suckers are in two series obliquely set. The horny ring (Textfig. 5) bears twelve stout teeth on its distal semicircumference. The papillated area is of the usual structure (Textfig. 6). The buccal membrane has the usual seven angles, long and pointed and provided with from eight to ten suckers on the inner aspect (Textfig. 4). Both the outer and inner lips are thick and folded.

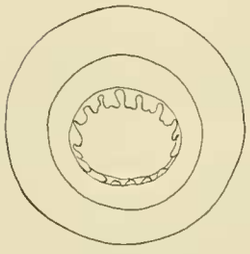

Fig. 4.

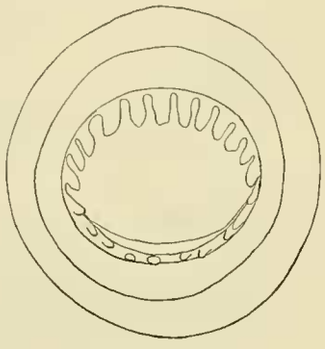

Fig. 5.

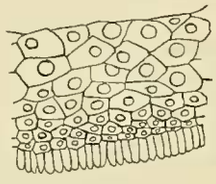

Fig. 6.

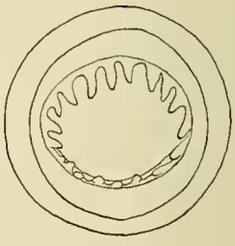

Fig. 7.

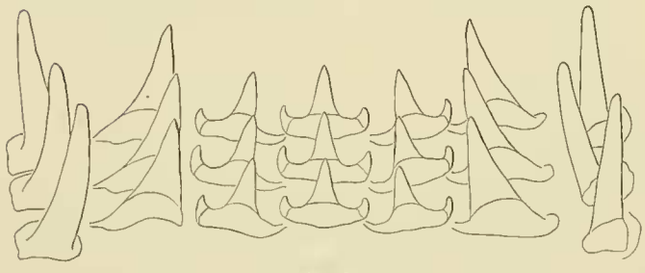

Fig. 8.

Fig. 4. *Loligo reynaudi,* sucker from the buccal membrane. × 40.

Fig. 5. *Loligo reynaudi,* sucker from one of the arms. × 20.

Fig. 6. *Loligo reynaudi,* portion of the papillary area from a sucker. × 70.

Fig. 7. *Loligo reynaudi,* a lateral tentacular sucker. × 20.

Fig. 8. Radula of *Loligo reynaudi.* × 25.

The Tentacles are not quite so long as the mantle, with stout rounded stems; the club occupies nearly half their length and is but slightly expanded. About ten suckers in its middle portion are much enlarged and have a smooth horny ring. Both the proximal and distal suckers as well as those on the margin of the club are very oblique and have narrow acute teeth with wide interspaces between them (Textfig. 7).

The Surface is smooth.

The Colour is a dull yellow with purple chromatophores much more closely set above than below, giving the back a deep purple appearance.

The Gladius is of the usual structure, but is long and narrow in correspondence with the form of the mantle.

Dimensions of Specimen H 1352.

	mm		mm
Length, total	360	Eye to edge of umbrella	33
End of body to mantle margin	227	Length of fin	155
End of body to eye	235	Breadth of fin	120
Breadth of body (without fins)	53	Diameter of largest sucker on sessile arm	2,7
Breadth of head	42	Diameter of largest sucker on tentacle	9

	Right	Left		Right	Left
Length of first arm	62	73	Length of fourth arm	93	88
Length of second arm	77	74	Length of tentacle	184	162
Length of third arm	104	87			

Sepia tuberculata.

1798 *Sepia tuberculata* Lamarck, Bull. sci. Soc. Philomath. Paris, Vol. II, p. 130.
1799 „ „ Lamarck, Mém. Soc. Hist. nat. Paris, T. I, p. 9, tab. 1, fig. 1.
1832 „ *papillata* Quoy et Gaimard, Moll. „Astrolabe", Vol. II, p. 61, tab. 1, figs. 6—14.
1845 „ *tuberculata* d'Orbigny, Moll. viv. et foss., p. 281, tab. 12, fig. 11. (Further references are here given.)
1848 „ „ d'Orbigny, in: Férussac et d'Orbigny, Monogr. Céphalopodes acétabulifères, p. 277, tab. 3ter, 4bis, 6, and 17, figs. 13—15.
1875 „ „ ?Steenstrup, *Hemisepius*. K. Dansk. Vid. Selsk. Skr., (5) Vol. X, p. 474—479, tab. 1, figs. 20, 21; tab. 2, fig. 6.

Locality: Angra Pequena. Three specimens, ♀ (H 1355—57).

The Body is stout and broad, the greatest breadth being about the middle of its length. The posterior extremity is bluntly rounded. The fin is of medium breadth; it begins about 3 mm from the anterior border of the mantle and just meets its fellow of the opposite side at the posterior extremity. The mantle margin projects but slightly over the head, and is bluntly rounded there, and slightly emarginate below. The siphon reaches almost to the interspace between the ventral arms. The head is broad and apparently long, owing to the extent of the interbrachial membrane.

The Arms are comparatively short, the order of length being 1 = 2 = 4, 3, about as long as the mantle, conical and rounded. There is a narrow web at either side of the sucker bearing surface; the ventral arms are flattened and triangular in section with a very distinct keel on the outer edge for about half way up; beyond this the angle is rounded and the integument thrown into minute corrugations like a number of papillae closely packed together. The suckers are in four rows, a little irregular here and there, owing to mutual pressure, they are spheroidal with meridional grooves around the edge. The horny ring is smooth. No hectocotylus was observed.

The Umbrella is well developed reaching about half-way up the dorsal and lateral arms, rather less between the ventro-lateral and ventral arms, and scarcely present between the ventral arms. The buccal membrane is much thickened at the edge, and thrown into a series of complex foliations; a deeply placed ligament passes to the interspace between the dorsal arms; one is attached to the dorsal aspect of each dorso-lateral arm, and another to the ventral aspect of each ventro-lateral arm bordering the tentacular pit; the spermatic pad was not observed but a number of spermatophores were attached to the outer lip (Textfig. 9). The outer lip is thin and longitudinally ribbed, the inner thick with the margin densely papillate.

The Tentacles are almost as long as the mantle, the stems trihedral with rounded angles, the club lanceolate with a well developed web on the dorsal aspect, and a protective membrane on either side of the sucker-bearing face. In the middle line are four suckers conspicuously larger than the rest (Pl. Va, Fig. 4). The relative sizes of these vary in different specimens and even in the two tentacles of the same individual, but in every case the second is the largest, sometimes the first sometimes the fourth

is the smallest, in one instance the first and third are subequal. The proximal and lateral small suckers have the horny ring finely denticulate, the teeth larger on the distal than on the proximal side of the ring; the same is the case with the small suckers immediately succeeding the large ones, but those forming a group at the tip of the tentacle have smooth rings. The horny ring of the large tentacular suckers is smooth as is that of a few smaller ones in the interspaces between them.

The Surface of the dorsal aspect of the head, body and arms, is covered with the close-set flattened tubercles, varying from 1 to 2 mm in diameter; they are largest in the centre of the back (Pl. Va, Fig. 8) and head (Fig. 7), becoming smaller and less closely packed towards the sides. With a simple lens these tubercles are seen to be compound, consisting of a central papilla with from four to seven in a circle round it (Fig. 9). It is quite possible that in a state of erection these structures might present the appearance shown by QUOY and GAIMARD (op. cit., tab. 1, figs. 7, 8), though I hardly think it likely they can attain so great a length as there shown. Their microscopic structure is described below. The under surface is smooth except for two elliptical patches one on either side of the middle line of the lower surface of the mantle (Fig. 4). These are very distinct in the largest specimen, less so in the other two; their colour (in the spirit specimen) is a pale dull yellowish, the pinkish tinge and the dark

Fig. 9.

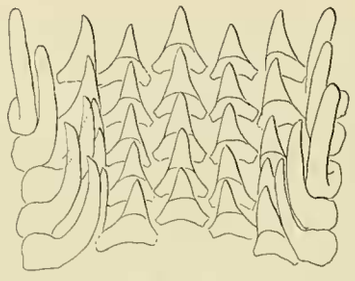

Fig. 10.

Fig. 9. *Sepia tuberculata,* buccal membrane and inner and outer lips, showing spermatophores adhering to the latter. Natural size.

Fig. 10. Radula of *Sepia tuberculata.* × 20.

brown chromatophores seen in the rest of the mantle being conspicuously absent. This portion of the surface is thrown into much larger wrinkles than the rest, but whether these are entirely or only partially due to the action of the alcohol, there are no means of deciding. The minute structure is described below.

The Shell (Figs. 5, 6) is broadly elliptical in the anterior half, the lateral margins more separated behind so as to produce a sub-angular contour. The chitinous margin is of medium breadth from 3 to 4 mm. The dorsal surface has a slightly elevated, rounded ridge, along the median line, becoming gradually broader as it passes forwards, it is closely covered with rows of tubercles arranged parallel to the anterior margin; in the posterior half these tubercles become fused into a fine irregular network. The ventral surface is smooth and elevated, the shell being thickest just in front of the middle; the last loculus has an index of about 33, and is bounded behind by lines inclined to each other at an angle a little less than a right angle, and connected by a broad blunt curve in front. The striated area is much hollowed, and is marked by lines roughly parallel with the curve just mentioned, the angle becoming more obtuse posteriorly; the lines are finely undulate; it has a distinct groove along the middle line. The inner cone consists of two broad flat chitinous strips, bordering the posterior third of the striated area, and uniting in the middle line behind to enclose a very shallow depression. The spine is short and blunt.

Dimensions of Specimen H 1357.

	mm		mm
Length, total	190	Breadth of fin	13
End of body to mantle margin	115	Diameter of largest sucker on sessile arm	2,5
End of body to eye	123	Diameter of largest sucker on tentacle	7,5
Breadth of body (without fins)	72	Length of Shell	103
Breadth of head	53	Breadth of Shell	49
Eye to edge of umbrella	50		

	Right	Left		Right	Left
Length of first arm	55	54	Length of fourth arm	51	55
Length of second arm	51	56	Length of tentacle	109	130
Length of third arm	59	65			

That these specimens belong to the same species as *S. papillata* Q. and G., admits, I think, of no doubt. That this is a synonym of *S. tuberculata* LAMARCK is made quite clear by D'ORBIGNY's identification, he having had the types of both species for comparison. This is confirmed by the fact that LAMARCK figures the two elliptical patches above described. His representation of the tentacular suckers must be regarded as merely conventional, but it is remarkable that he should not have noticed and recorded the arrangement of the suckers in the club. D'ORBIGNY's statement "C'est à tort que les tubercules ont été représentés comme coniques" (p. 274), shows that the drawing was not quite accurate. The present examples seem to be lighter in colour than the types, they could scarcely be described as "violet foncé" above. What LEACH's *S. mamillata* was, if not this species, it is impossible to say; in any case it is only a manuscript name and the drawing is obviously inaccurate.

I am rather at a loss to determine the exact relation between these specimens and the two referred (through with some doubt) by STEENSTRUP (loc. cit.) to the same species. This author describes the suckers in his examples as being in eight rows at the distal extremities of the arms. This is certainly not the case in those submitted to me. It is noteworthy also that the spermatophores in STEENSTRUP's specimen are attached to the outer side of the buccal membrane whilst in one of the examples, here described, they are affixed to the outer lip inside the buccal membrane.

Microscopic Structure.

The histological details are very inadequately preserved, but still in view of the rarity of the species I have thought it best to give a brief account of the minute structure of the modifications of the epidermis.

The dorsal Papillae (Pl. Va, Figs. 10, 11).

The centre of each primary papilla consists of a mass of muscular fibres, running in all directions (Fig. 10). Into each secondary papilla this muscular basis is prolonged (*m*), the central portion consisting of transverse fibres, crossing each other at various angles. Down the sides of the secondary papilla run longitudinal fibres (*m l.*), parallel with its axis. They do not appear to form a continuous coat but to take the shape of isolated bundles. The spaces between the secondary papillae are filled with connective tissue, in which large chromatophores occur here and there (*ch*). The epithelium is columnar (Fig. 11 *ep.*) and consists for the most part of very slender cells with sausage-shaped nuclei; a number of smaller cells with rounded nuclei lie between the bases of the longer cells. Below the epithelium the connective tissue is divided into compartments by the radial muscular strands, which pass out to the basal membrane; many of these interspaces contain large masses of granular material, sometimes with nuclei (Fig. 11 *g*), which are apparently disintegrated cells.

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The Papillae of the ventral Arms (Pl. Va, Figs. 12, 13).

The external surface of the ventral arms is covered by a mass of rounded papillae, averaging 0,3 mm in diameter and aggregated into masses of a dozen or more. They are covered with epithelium closely resembling that just described (Fig. 13 *ep*), below which is a mass of connective tissue raised up into a heap in the centre of each papilla (Figs. 12, 13 *c*); it rests upon the subcutaneous muscle bundles (*sm*). It is devoid of chromatophores.

The ventral Mantle Patches (Pl. Va, Fig. 14).

The two oval patches on the ventral aspect of the mantle, above described, are very similar in minute structure to the papillary areas on the arms. The epithelium is of the same character but between its cells are found here and there deeply stained granular cells, which appear to have undergone degeneration. The subjacent connective tissue resembles that below the papillae in having no chromatophores, but differs from it in being traversed by large blood-vessels (*v*). As regards the function of these structures it seems most probable that the dorsal papillae are protective. If these are anything like as erectile as is shown in Quoy and Gaimard's figure a surface could be produced, which might closely resemble an animal or vegetable growth upon the rocks amongst which the animal lives.

The other organs are probably similar in function, but it is difficult to suggest what this may be. Nowadays in considering any problematic organ in a Cephalopod the first question is whether it may not be a luminous organ. These structures, however, do not resemble any luminous organs which I have seen or read of, and I am at a loss to find any more plausible suggestion.

Plate Va.

c. connective tissue
ch. chromatophores
ep. epithelium
g. granular cells
m. muscle fibres
ml. muscle fibres, longitudinal
sm. subcutaneous muscle bundles
v. blood vessels

Polypus schultzei.

Fig. 1. Inner aspect of the arms to show the size and arrangement of the suckers; × ¾.
„ 2. Ventral side of the end of the hectocotylised arm; × ¾.
„ 3. Tip of the hectocotylised arm; × 3.

Sepia tuberculata.

„ 4. Ventral surface, showing the arrangement of the tentacular suckers, the papillae near the tip of the ventral arm, and the two corrugated areas on the ventral aspect of the mantle; about two-thirds natural size.
„ 5. Dorsal aspect of the shell; almost natural size.
„ 6. Ventral aspect of the shell; almost natural size.
„ 7, 8. Portion of the dorsal surface; (7) of the head; (8) of the mantle; almost natural size.
„ 9. Portion of the dorsal surface of the mantle; × 3,5.
„ 10. Section through one of the dorsal papillae; × 25.
„ 11. Section near the upper part of one of the secondary papillae; × 340.
„ 12. Section through the papillary area near the tip of the ventral arm; × 25.
„ 13. Section through the tip of one of the papillae of the ventral arm; × 340.
„ 14. Section through part of the corrugated portion of the ventral surface of the mantle; × 25.

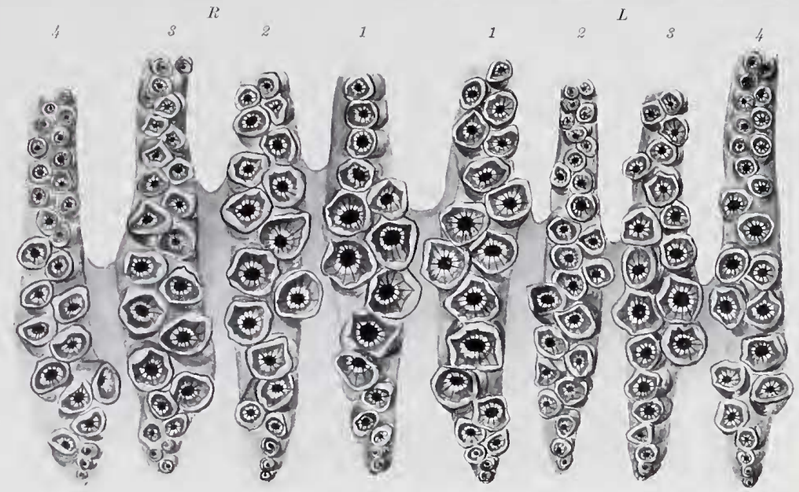

Fig. 1.

Fig. 2.

Fig. 3.

Fig. 5.

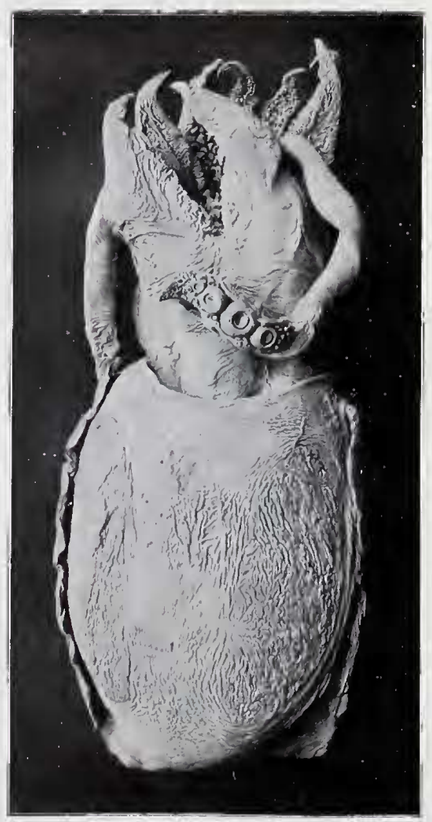

Fig. 4.

Fig. 6.

Fig. 7.

Fig. 9.

Fig. 8.

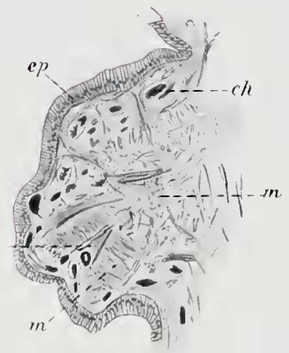

Fig. 10.

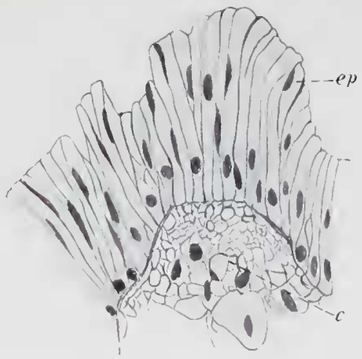

Fig.-13.

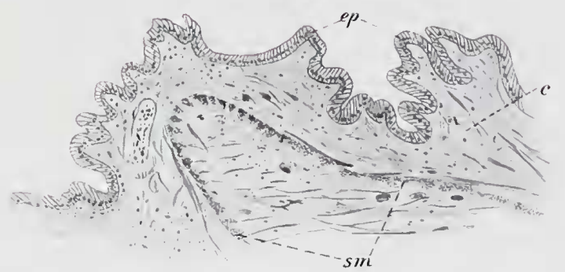

Fig. 12.

Fig. 14.

Fig. 11.

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